

Appl. No. 10/662,073
Amdt. dated February 12, 2007
Reply to Office Action of January 10, 2007

Amendments to the Specification:

Please replace the paragraph beginning at page 3, line 4 with the following amended paragraph:

-- The present invention is directed to absorbent composites comprising superabsorbent ~~material~~^{material}, which may address the above-described problems associated with currently available absorbent composites. The absorbent composites of the present invention may comprise superabsorbent ~~material~~^{material}, where the superabsorbent ~~material~~^{material} has: an Absorption Time of about $5+10 a^2$ minutes or greater, where a is the mean particle size of the superabsorbent material in millimeters; and a capacity as measured by the FAUZL test of about 15 g/g or greater. [[;]] The absorbent composites of the present invention have a Drop Penetration Value of about 2 seconds or less; and, a $\frac{1}{2}$ Float Saturation of about 50% or less. Such a combination of properties for superabsorbent ~~material~~^{material} may enable an absorbent composite to provide beneficial behavior in terms of not locking up all the liquid in the vicinity of where liquid enters the absorbent product thus providing better liquid distribution and maintaining a lower level of saturation in the target area to provide a more intake-friendly structure for a longer portion of the absorbent composite life. Unlike some known absorbent composites, which lose their fluid intake performance over the life of the absorbent composite, the absorbent composites of the present invention may exhibit superior liquid distribution and fluid intake after multiple insults to the absorbent composite. --

Please replace the paragraph beginning at page 3, line 21 with the following amended paragraph:

-- The present invention may be further directed to absorbent composites comprising superabsorbent ~~material~~^{material} and fibrous material, and their applicability in disposable personal care absorbent products. The absorbent composites of the present invention may be useful as absorbent components in personal care absorbent products such as diapers, feminine pads, panty liners, incontinence products, and training pants. --

Appl. No. 10/662,073
Amdt. dated February 12, 2007
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Please replace the paragraph beginning at page 4, line 1 with the following amended paragraph:

-- **Figure 3** is a cross-sectional view of a portion of the equipment for determining the Flooded Absorbency Under Zero Load (FAUZL) value shown in **Figure 2** and taken along section line **[[B-B]]3-3.** --

Please replace the paragraph beginning at page 4, line 5 with the following amended paragraph:

-- **Figure 4** is a cross-section view of a portion of the equipment for determining the Flooded Absorbency Under Zero Load (FAUZL) value shown in **Figure 2** and taken along section line **[[A-A]]4-4.** --

Please replace the paragraph beginning at page 6, line 13 with the following amended paragraph:

-- Superabsorbent materials having a slow absorption rate, combined with the properties discussed above, may be suitably used in absorbent composites and/or absorbent products. The slow absorption rate of the superabsorbent material may allows-allow the liquid coming into the absorbent composite to move to remote regions from the target area prior to being locked up by the superabsorbent material. As used herein, the term "Target area" refers to the immediate vicinity of where liquid enters the absorbent product. Absorbent composites incorporating such superabsorbent materials may be able to achieve higher utilization of the absorbent capacity of the absorbent in an absorbent product. Also, superabsorbent materials having a slower absorbent rate, when used in the target area, may be able to reduce the tendency of the target area from reaching its absorbent capacity prematurely and thus reduce leakage of the absorbent product. --

Appl. No. 10/662,073
Amdt. dated February 12, 2007
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Please add the following new paragraphs after the paragraph ending on line 17 of page 4:

-- **Figure 9** is a plan view of an embodiment of the disposable diaper of the present invention shown in a semi-finished condition; and

Figure 10 is a sectional view of cross section 5-5 shown in **Figure 9**. --

Please replace the paragraph beginning at page 18, line 12 with the following amended paragraph:

-- Superabsorbents identified as C1, C9 - C11 are available from Stockhausen Inc., Greensboro, NC. Superabsorbent C1 is FAVOR SXM 880, a lightly crosslinked, partially neutralized, sodium polyacrylate polymer available from Stockhausen, Inc. Superabsorbents C2 and C3 were prepared as set forth in U. S. Patent No. 4,548,847 (discussed in further detail below). Superabsorbent C4 is IM-5000 a lightly crosslinked, partially neutralized, sodium polyacrylate polymer available from Hoescht-Celanese (now BASF) of Portsmouth, Virginia. Superabsorbents C5 and C6 are hydrophobic surface treatment modifications to superabsorbent C4 based on the teachings from WO 9847951 (discussed in further detail below). Superabsorbents C7 and C8 are AQUALIC Aqualie CA-W4 available from Nippon Shokubai Co., Osaka, Japan (discussed in further detail below). Superabsorbent C7 was prepared by sieving a sample of AQUALIC Aqualie CA-W4 and collecting that material which was retained upon a #140 U.S. Standard Sieve but passed through a #50 U.S. Standard Sieve. Superabsorbent C8 was prepared by sieving a sample of AQUALIC Aqualie CA-W4 and collecting that material which was retained upon a #30 U.S. Standard Sieve but passed through a #20 U.S. Standard Sieve. Superabsorbents C9 and C10 are FAVOR SXM 870, a lightly crosslinked, partially neutralized, sodium polyacrylate polymer available from Stockhausen, Inc. Superabsorbent C9 was prepared by sieving a sample of FAVOR SXM 870 and collecting that material which was retained upon a #140 U.S. Standard Sieve but passed through a #50 U.S. Standard Sieve. Superabsorbent C10 was prepared by sieving a sample of FAVOR SXM 870 and collecting that material which was retained upon a #30 U.S. Standard Sieve but passed through a #20 U.S. Standard Sieve. Superabsorbent C11 is W77553 (P15087), a lightly crosslinked, partially

Appl. No. 10/662,073
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neutralized, sodium polyacrylate polymer with a hydrophobic coating available from Stockhausen, Inc. --

Please add the following new paragraph after the paragraph ending on line 25 of page 10:

-- Turning now to **Figure 9**, there is shown an embodiment of a disposable diaper provided by the present invention. An outer cover 20 is shown in plan view with an absorbent structure 22 disposed thereon. Outer cover 20 is shown with leg hems 24, back waist flap 26 and front waist flap 28 unfolded. Foldline 30 indicates where back waist flap 26 is folded. Similarly, foldline 32 indicates where front waist flap 28 is folded. Foldlines 34 indicate where hems 24 are folded. Line 36 shows the periphery of absorbent composite 38. Referring to **Figure 10** in conjunction with **Figure 9**, absorbent structure 22 comprises a resiliently stretchable liquid permeable bodyside liner 42 bonded to a liquid impermeable barrier 44 with absorbent composite 38 retained therebetween. It is contemplated that any appropriate means for bonding bodyside liner 42 to barrier 44 may be used. A preferable method of bonding bodyside liner 42 to barrier 44 is any autogenous bonds such as the bonds produced by sonic or ultrasonic energy. A function of the bonding between bodyside liner 42 and barrier 44 is to maintain absorbent composite 38 disposed therebetween and to maintain absorbent structure 22 as a unitary structure. Depending upon the composition of absorbent composite 38 the bonding between bodyside liner 42 and barrier 44 may be continuous or a series of discrete points. Another function of the bonding of resiliently stretchable bodyside liner 42 to barrier 44 is to provide a desired shape to the absorbent structure 22. This is accomplished by bonding resiliently stretchable bodyside liner 42 to barrier 44 while bodyside liner 42 is in a stretched condition. A desired shape is achieved by selectively stretching bodyside by applying a tensioning force to selected peripheral portions of resiliently stretchable bodyside liner 42. For example, if the liner 42 is stretched in a vertical direction during bonding, absorbent structure 22 will assume a folded shape, i.e., the ends converging toward each other, when the tensioning force is removed. Furthermore, if resiliently stretchable bodyside liner 42 is bonded to barrier 44 while bodyside liner 42 is stretched in a crossbody direction by the application of a second tensioning force, the resiliency of bodyside liner 42 will cause absorbent structure 22 to assume a cupped

Appl. No. 10/662,073
Amdt. dated February 12, 2007
Reply to Office Action of January 10, 2007

profile in a crossbody direction when the second tensioning force is removed. It is noted that for the sake of clarity only a few autogenous bonding points 40 are shown and numbered. Other methods, such as pressure or heat sensitive adhesives may be used and are to be considered within the scope of the present invention. As shown in Figure 10, absorbent structure 22 is disposed upon outer cover 20. --

Please delete the paragraph beginning at page 31, line 13, which starts and ends with "Results and analysis".

Please replace the paragraph beginning at page 31, line 15 with the following amended paragraph:

-- 10. Calculate the grams of saline absorbed per gram of superabsorbent polymer, and plot as a function of cumulative soak time. --

Please replace the paragraph beginning at page 31, line 18 with the following amended paragraph:

-- 11. Determine the final equilibrium absorption capacity of the superabsorbent material: if there is less than a 5% change in the average capacity (average of three tests) of the superabsorbent material obtained at 90 and 120 minutes then use the capacity at 120 minutes as the equilibrium capacity, FAUZL. If there is greater than a 5% change in the average capacity, then the sample testing will need to be repeated and will need to include an additional sampling at a cumulative soak time of 200 minutes. Use the capacity at 200 minutes as the equilibrium capacity, FAUZL, for this latter situation. --

Appl. No. 10/662,073
Amtd. dated February 12, 2007
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Please replace the paragraph beginning at page 31, line 27 with the following amended paragraph:

-- 12. Determine the interpolated time to reach 60% of the equilibrium absorption capacity. This is done by calculating the capacity at 60% of the equilibrium value, then estimating the corresponding time to reach this capacity from the graph. The interpolated time to reach 60% capacity (by this procedure), is obtained by performing a linear interpolation with the data points that lay to either side of the estimated time. --

Please replace the paragraph beginning at page 31, line 33 with the following amended paragraph:

-- 13. Calculate the arithmetic average interpolated time to reach 60% of the equilibrium capacity (average of three tests). This average value is referred to as "Absorption Time." --

Please replace the paragraph beginning at page 32, line 4 with the following amended paragraph:

-- A suitable piston/cylinder apparatus for performing the GBP test is shown in Figures 5 and 6. Referring to Figure 5, apparatus 228 consists of a cylinder 234 and a piston generally indicated as 236. As shown in Figure 5, piston 236 consists of a cylindrical LEXAN[®] shaft 238 having a concentric cylindrical hole 240 bored down the longitudinal axis of the shaft. Both ends of shaft 238 are machined to provide ends 242 and 246. A weight, indicated as 248, rests on end 242 and has a cylindrical hole 248a bored through the center thereof. Inserted on the other end 246 is a circular piston head 250. Piston head 250 is sized so as to vertically move inside cylinder 234. As shown in Figure 6, piston head 250 is provided with inner and outer concentric rings containing seven and fourteen approximately 0.375 inch (0.95 cm) cylindrical holes, respectively, indicated generally by arrows-lead lines 260 and 254. The holes in each of these concentric rings are bored from the top to bottom of piston head 250. Piston head 250 also has cylindrical hole 262 bored in the center thereof to receive end 246 of shaft 238.--

Appl. No. 10/662,073
Amdt. dated February 12, 2007
Reply to Office Action of January 10, 2007

Please replace the paragraph beginning at page 32, line 24 with the following amended paragraph:

-- Cylinder 234 is bored from a transparent LEXANLEXAN[®] rod or equivalent and has an inner diameter of 6.00 cm (area = 28.27 cm²), a wall thickness of approximately 0.5 cm, and a height of approximately 5.0 cm. Piston head 250 is machined from a LEXANLEXAN[®] rod. It has a height of approximately 0.625 inches (1.59 cm) and a diameter sized such that it fits within cylinder 234 with minimum wall clearances, but still slides freely. Hole 262 in the center of the piston head 250 has a threaded 0.625 inch (1.59 cm) opening (18 threads/inch) for end 246 of shaft 238. Shaft 238 is machined from a LEXANLEXAN[®] rod and has an outer diameter of 0.875 inches (2.22 cm) and an inner diameter of 0.250 inches (0.64 cm). End 146 is approximately 0.5 inches (1.27 cm) long and is threaded to match hole 262 in piston head 250. End 242 is approximately 1 inch (2.54 cm) long and 0.623 inches (1.58 cm) in diameter, forming an annular shoulder to support the stainless steel weight 248. The annular stainless steel weight 248 has an inner diameter of 0.625 inches (1.59 cm), so that it slips onto end 242 of shaft 238 and rests on the annular shoulder formed therein. The combined weight of piston 236 and weight 248 equals approximately 596 g, which corresponds to a pressure of 0.30 psi (20,685 dynes/cm²) for an area of 28.27 cm². --

Please replace the paragraph beginning at page 33, line 15 with the following amended paragraph:

-- The superabsorbent layer used for GBP measurements is formed by swelling approximately 0.9 g of a superabsorbent material in the GBP cylinder apparatus (dry polymer should be spread evenly over the screen of the cylinder prior to swelling) with an aqueous 0.9 weight percent sodium chloride solution for a time period of about 60 minutes. The sample is taken from superabsorbent material which is prescreened through U.S. standard #30 mesh and retained on U.S. standard #50 mesh. The superabsorbent material, therefore, has a particle size of between 300 and 600 microns. The particles may be pre-screened by hand or automatically pre-screened with, for example, a TapRO-TAP Mechanical Sieve Shaker Model B available from W. S. Tyler, Inc., Mentor, Ohio. --

Appl. No. 10/662,073
Amdt. dated February 12, 2007
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Please replace the paragraph beginning at page 35, line 18 with the following amended paragraph:

-- The particle size distribution of superabsorbent material is determined by placing a known weight of a sample in a RO-TAP Re-Tap mechanical sieve shaker with U.S. standard sieves and shaking it for a specified period of time under defined conditions. Sample sections that are retained on each sieve are used to compute the mean particle size. --

Please replace the paragraph beginning at page 35, line 23 with the following amended paragraph:

-- 25 ± 0.1 grams of superabsorbent is weighed and set aside for testing. The sieves are stacked on to the RO-TAP Re-Tap in the following order from bottom to top: bottom pan, 325 mesh, 170 mesh, 50 mesh, 30 mesh, and 20 mesh. The superabsorbent sample weighed above is poured into the top sieve (#20) and then the sieve is covered. The RO-TAP Re-Tap is allowed to run for 10 minutes and then stopped. The amount of superabsorbent retained on each pan is noted. The mass fraction of superabsorbent retained on each sieve_i is referred to as m_i , and is computed by taking the ratio of the retained mass of superabsorbent to the total mass of superabsorbent. For the purpose of computing the mean particle size, it is assumed that all the particles retained on a particular sieve have a size r_i , equal to the average of the sieve above and sieve it is retained on. For example, superabsorbent retained on the 50 mesh screen would be inferred to all be 450 μm (average of 300 μm corresponding to the 50 mesh and 600 μm corresponding to the 30 mesh). Samples retained on the 20 mesh sieve are assumed to be 1000 μm size. Samples retained on the pan are assumed to be 22 μm (average of 44 μm corresponding to the 325 mesh and 0 μm corresponding to the pan). The mean particle size is then computed as:

$$\text{MeanParticleSize} = \sum m_i * r_i --$$

Appl. No. 10/662,073
Amdt. dated February 12, 2007
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Please replace the paragraph beginning at page 38, line 13 with the following amended paragraph:

-- The test absorbent composite 701 is immediately removed from the cradle 703 and placed on a 2.5 inches (6.35 cm) by 6 inches (15.24 cm) pre-weighed dry pulp fiber/superabsorbent material desorption pad having a total basis weight of 500 gsm and a density of about 0.20 g/cc and a superabsorbent material wt % of 60 in a horizontal position under 0.05 psi pressure for 15 minutes. The superabsorbent material is suitably FAVOR 880, available from Stockhausen, Inc. (Greensboro, NC). The pulp fiber is suitably ~~Geesa~~ COOSA 1654, available from Alliance Forest Products (Coosa Pines, AL). This pressure is applied by using a Plexiglas plate and any necessary additional weight to uniformly apply 0.05 psi pressure over the entire 2.5 inch by 6 inch pad area. After the 15 minutes, the desorption pad weight is recorded and the test absorbent composite 701 is placed back in the cradle 703 in the same position and a second insult of 100 ml is done. After the amount of run-off is recorded, the test absorbent composite 701 is once again placed on a pre-weighed dry desorption pad under 0.05 psi (dynes/cm²) load for 15 minutes. After 15 minutes, a weight of the desorption pad is recorded. The absorbent composite 701 is placed back in the cradle 703 for a third insult. --